One panelists – additional comments on conceptual models

General Comments

- Overall, the assumptions behind the various frameworks are most revealing. My conclusion is that the risks associated with each model boil down to:
    - the potential for a mistaken assumption about "optimization" for biologically-based frameworks. That is, by setting thresholds, we propose to know what's best for salmon. This risk is reduced by incorporating uncertainty and precautionary factors, but can't be eliminated.
    - Isolation of temperature from other physical (and biological) factors in physically-based frameworks. The physically-based frameworks are appealing in that historic conditions or potential are the standard; but as mentioned above, given potential shift in the habitat and/or the biology, historic potential may not always be "best".
- I'm left with the conclusion that a good approach might use system physical potential as the first "screen", which is then overlain with the biological requirements and distribution of the fish.

Natural physical potential model

- Under **What metric would be modeled or predicted** section: "Even with only a daily ~~maximum~~ average? prediction, daily maximum could be estimated by correlation to daily average." And in following sentence, "….the direction of error is such that maximum temperature under restored conditions would likely be too high." I don't understand this.
- Under **Aren't you missing or ignoring…refugia** with a model section. Last two sentences should be deleted. While I understand that aggregate or average predicted temperatures for a reach are unaffected by fine-scale variation, and that cold refugia are often offset by warm areas, these last two sentences downplay the main point of a credible response; which should be that yes, modeling will miss fine-scale variation, and that monitoring would be the best way to address this pattern. The issue being questioned is spatial heterogeneity, so the response shouldn't be clouded by including a discussion of aggregate or average temperatures. While it's important to clarify and correct the mistaken assumption that refugia somehow cool reach-level temperatures, this should be done elsewhere.
- Under model needs, **stream channel characteristics** section: how will *potential* channel dimensions be assessed, or will these be assumed static (which probably wouldn't be accurate given responses to riparian restoration)?
- Similarly, under **flow** section, are current and potential groundwater inflow assumed to be equal? Probably not a valid assumption, but of course difficult to model. Also, are adequate flow data really available for region streams??
- An important assumption of this model is that historic temperature regimes are best for salmon under current conditions. This assumption needs to be critically examined, and where it is relied upon, either in this model or other models, should incorporate some safeguards to prevent a mis-match of temperature regimes to

present-day habitat and fish distributions and life-histories. For example, if the historic distribution of high quality habitat has shifted, and along with it has shifted the life-history parameters of salmonids, restoring historic temperature regimes may not be optimal for "viability". For instance, if the most productive spring Chinook habitat is presently located in high elevation headwater reaches, current Chinook life histories may reflect seasonal movement and maturation schedules tied to those spawning and rearing locations. Though perhaps unlikely, it's quite possible that reductions of temperatures in those headwater reaches (if those temperatures are now "optimal" for Chinook, but above historic physical potential) could have adverse affects on the existing population and life history structure. This is a simple example, but I suspect there may be other more complex shifts in species life history patterns from historic patterns that may no long match the physical potential of the stream system. Simply restoring the historic temperature regime, without simultaneous and appropriate restoration of habitat and life history "potential", might be misguided. Somehow, a "check" or a filter of this model with current fish life history patterns and habitat distributions should be incorporated.

Distributional thresholds conceptual framework

- General comment, I found this framework to be very intriguing and appealing in some way, but as discussed at length by the group, I also agree that the problems associated with delineation and implementation are huge. One problems not mentioned by the group is how distribution is measured. I assume it's a linear proportion of a basin. If so, then stream size and location would be important factors to use to stratify classifications. For instance, 1 km of cold water habitat in the mainstem at the lower distributional limit of a sensitive salmonids would not be equal in "value" to 1 km of stream in the headwaters.
- The information needs for implementing this framework would be huge, it'd require a "Temperature Czar" for each basin that was fully informed about both the biology and thermal potential of the basin. Even after 7 years studying fish and temperature in the basin I'm most intimate with, I'd have to rely on an unreasonable amount of guesswork to implement this concept.